

THE DESTRUCTION OF FLY LARVAE IN HORSE MANURE.

MAJOR LÉLEAN, in one of the lectures of his course on military hygiene and the efficiency of the soldier, reported recently in the *JOURNAL*, said that experiments were being made in connexion with the present military operations by the application to manure heaps of 1 lb. of crude borax to every 15 cubic feet, and mentioned that kerosene and chloride of lime had been found too costly. Experiments with a large number of chemicals have been made by a scientific commission in the United States, containing representatives of the Bureau of Chemistry, Entomology and Plant Industry, and the results were reported in Bulletin No. 118 of the United States Department of Agriculture published last July.

In the first place it is pointed out that stable manure is one of the most valuable fertilizers known, and is of such importance that experiments have been made to increase the economic value by chemically retarding the great loss in nitrogenous constituents from aerobic fermentation in the open. The data as to the development of the house-fly were discussed by Dr. Shipley in the *JOURNAL* of October 17th, 1914, when he showed that the times varied a good deal according to the temperature. Those taken by the American Commission were that the fly crawls an inch or so beneath the surface of the heap to lay its eggs, and that these hatch in a day; that the larval stage continues from four to five days, during which migration takes place to the sides in the direction of the base; that the pupae are to be found at the outer edges near the ground; and that the fly is matured in about ten days.

The manure experimented upon was placed both in specially constructed cages and in open piles on the ground, controls being established in all cases.

The cages were designed to treat 10 cubic feet of manure, to prevent escape of maggots or introduction of fresh contamination from outside, to allow drainage of superfluous liquid, and to secure the sole exit of flies into one of a pair of fly traps fixed to the top. This last was materially assisted by covering the sides with a black curtain at the period of maturing, so that the only light was admitted by the hole leading to the trap. The top could be moved for filling, and samples could be taken through a small door on one side. The manure in each series of experiments was taken from the same source, so that like samples could be placed in both experimental and control cages. The chemicals used were for the most part dissolved in 10 gallons of water, 2½ gallons being applied to each of four successive layers. An equal quantity of water was applied in like manner to the controls.

Although dead and living larval counts were taken with quart samples after a few days, the index of effectiveness was the difference in the total count of flies chloroformed in the traps during each experiment, this difference having to be well marked owing to there being no absolute security of equal infestation. To show the probable effect on fertilization properties, samples were taken at proper periods, with every precaution to ensure uniformity, for the purpose of bacterial counting and for chemical estimations of nitrogen, ammonia, amino-nitrogen, nitrates, nitrites, and reaction. The bacterial counts showed whether destruction or stimulation had taken place, and the chemical tests indicated whether valuable nitrogenous constituents had been diminished or increased.

The open pile experiments were carried out by treating 10 cubic feet of manure on each of four days, at the end of which period each heap measured 40 cubic feet. Eight or ten days after the last treatment the piles were searched for pupae and the numbers compared. Chemical and bacteriological examinations were also made in some cases.

Twenty-four different chemicals were tried in various concentrations, but only seven showed decided larvicidal action in the strengths used. In summarizing the results, the term "satisfactory" is used to indicate destructive action on fly larvae, non-injurious effect on manure, and lack of extremely poisonous properties. The "unsatisfactory" or "partially satisfactory" class includes some which have little or no larvicidal qualifications but may aid fertilization, some which require large amounts to be effective, and others which, though fulfilling the main

purpose, either impoverish the manure, or have extremely poisonous properties. The latter class includes kerosene, kainit (potassium chloride and magnesium sulphate), Isthmian Canal Commission larvicide (prepared by heating carbolic acid, resin, and caustic soda, and highly effectual with mosquito larvae), iron sulphate, several proprietary disinfectants, potassium cyanide, formaldehyde, pyroligneous acid, common salt, copper sulphate, lime-sulphur mixture, Paris green, sodium fluoride, ammoniacal gas liquor, and calcium cyanamide. Further experiments are to be made with the last to find out if its known fertilizing properties will increase the value of the manure sufficiently to pay the cost of the large amount required to bring out its undoubted larvicidal properties.

The only chemicals which come under the "satisfactory" definition are borax and calcined colemanite, the latter being crude calcium borate, as mined in California, after subjection to a high temperature.

Of the two borates the ordinary commercial borax was found the most useful, owing to greater solubility, the smaller amount required for effective treatment, and its undoubted special toxic action on the eggs. That both borax and colemanite, however, are quite effectual in destroying larvae and pupae was shown by open pile experiments. Large numbers of black shrivelled pupae were found in some piles, and this excessive presence is explained either by cumulative action of the borates or the dosage being deferred until migration to the more saturated surface had taken place. That borates, when used with discretion, are not detrimental to the manure, but rather beneficial, was shown by the slight suppression of temperature in the piles, due to it is thought to their preventing the growth of organisms which produce "firefanging," by the greater totals of bacteria found and by the increase in nitrogenous matter, extending even to the production of nitrites and nitrates, indicated by chemical analysis. In order to make certain of the effect of treated manure on plants, extensive experiments were carried out both in greenhouses and in the open. These showed that any detrimental action is due to overdosage, but that if the minimum effective larvicidal amount is adhered to, no injurious effects are produced. The proper proportion recommended in 0.62 lb. of borax to 10 cubic feet (8 bushels) of manure, which roughly means 1 oz. per cubic foot, and 0.75 lb. of colemanite to the same quantity, and it is suggested that manure so treated should be applied to land in a proportion limited to a safe one of 15 tons per acre, at any rate until more is known of the cumulative effect.

Powdered borax or colemanite should be applied by means of a flour dredger, in the proportions given, immediately the fresh manure is removed from the stable, and particular attention should be paid to the outer edges of the pile, for reasons already indicated. Two or three gallons of water are then sprinkled over the heap. This treatment is, of course, repeated with each addition of fresh manure. It should also be applied to floors and crevices in barns, stables, markets, etc., to street sweepings, and to domestic refuse heaps.

The concluding paragraph relates to the important question of cost, and is as follows:

The amount of manure from a horse varies with the straw or other bedding used, but 12 or 15 bushels per week represent the approximate amount obtained. As borax costs from 5 to 6 cents per pound, in 100 lb. lots in Washington it will make the cost of treatment practically 1 cent per horse per day. And if calcined colemanite is purchased in large shipments the cost should be considerably less.

A previous paragraph mentions that calcined colemanite can be bought in large shipments at about 2 cents per pound.

POISONOUS GASES IN SUBMARINES.

A SURGEON R.N. has asked us where descriptions of symptoms of poisoning by carbon monoxide, petrol, and chlorine, can be found, with advice as to treatment of such accidents, which may occasionally arise in submarines. We have referred the question to Dr. F. J. Smith, who writes:

The three poisonous gases—chlorine, carbon monoxide, and petrol—are fairly discussed in the last edition of *Taylor's Medical Jurisprudence*, from which most of what

I have written for your correspondent's information has been taken, and to which I can add but little by way of general comment.

Summing the matter up, I would say that the danger of petrol is about equivalent to that of raw spirits of wine, both being the "essential article," and not mere dilutions. Chlorine is certainly very dangerous, owing to the suffocation produced by swelling of the mucous membrane of the air passages, for which there is little to be done; but there is not the rapid incapability of movement so frequently seen in the other two cases. Carbon monoxide is either rapidly fatal or of no consequence; but circumstances can be imagined in which the rapid unconsciousness might be of supreme moment, not only to the victim, but also to those who depend for their safety upon his activity.

Poisoning by Petrol.—Since the introduction of motor vehicles minor and even major attacks of this have become tolerably frequent. The symptoms in the minor cases are usually headache, soon followed by mental confusion and giddiness, not unlike the early symptoms of ordinary alcoholic intoxication, for which indeed many minor cases have been mistaken. With the giddiness there is an inability or disinclination to move. I cannot find any record of a fatal case, but a few are reported in which unconsciousness followed the giddiness. When the victim is returning from the unconscious condition he is apt to exhibit great irritability of temper and even to act somewhat violently if attempts are made to rouse him—another point of similarity between petrol poisoning and drunkenness.

As to treatment, there is little to be done beyond placing the victim in the fresh air and keeping the body as warm as circumstances will permit, thus allowing him as it were to "sleep it off." Warmth to the body is advisable as the loss of heat from the flushed skin may be serious.

Chlorine poisoning is not a common event outside chemical works. When chlorine is led into water, a certain small percentage of hydrochloric acid (HCl) is formed, as well as a simple solution of chlorine in water. The symptoms are due, first, to the irritating effects of simple chlorine as a gas on the bronchial mucous membrane; and, secondly, to the further intensely irritating, almost corroding, effect of the HCl. The symptoms are those of an acute laryngo-tracheo-bronchitis, intense fits of coughing, with their attendant asphyxial symptoms, amounting frequently to unconsciousness. These symptoms commonly grow worse and worse, till death ensues in twenty-four or forty-eight hours.

The victim must be, of course, at once removed from the gas, and then warm aqueous vapour is the best sedative; and, should the patient continue to live, the ordinary methods of treatment of acute bronchitis.

The symptoms of poisoning by CO in most cases may be said to be quite sudden unconsciousness without any preliminary manifestations, because, as a rule, the victim is suddenly exposed to a somewhat concentrated gas; the chief point about this unconsciousness is that the victim retains an exceptionally bright colour, due to the fact that COHb has a bright cherry-red tint, which, when seen through the skin, merely strikes the observer as a high colour. Unless aid is speedily rendered, this unconsciousness is very rapidly followed by death—so rapidly, indeed, that sudden unconsciousness and death constitute practically the whole picture. The records of cases of more gradual poisoning come chiefly from explorers in coal mines after an explosion who have met with the gas as the principal part of "after-damp." In these cases the symptoms described are those mainly of buzzing in the head and throbbing in the neck, coupled with the very important symptom of great muscular weakness (preventing or hindering escape), mental activity with confusion, and difficulty of connected attention. This stage may last, perhaps, a few minutes, during which the weakness increases, and then, if nothing is done, insensibility supervenes as in the sudden cases. In the air that is being respired a percentage of 0.17 is highly dangerous, and of 1 almost inevitably fatal.

The essential treatment is removal to fresh air (this at times seems for a moment to increase the symptoms), where artificial respiration should be performed. Strychnine hypodermically, or oxygen inhalations with a mask, should be tried in addition; the trouble is that COHb is a very stable compound dissociated with difficulty.

ROYAL MEDICAL BENEVOLENT FUND.

At the last meeting of the Committee thirty-nine cases were considered, and grants voted to thirty-five of the applicants. The following is a summary of the cases relieved:

Daughter, aged 59, of M.R.C.S.Eng. who practised at Long Sutton. Had worked as governess and housekeeper for many years, but owing to recent death of employer is now out of employment. Only income an investment bringing in £5 per annum, and age against obtaining fresh situation. Voted £12 in twelve instalments.

Daughter, aged 45, of M.R.C.S.Eng. who practised at Burghle-Marsh. Lives with mother, who has only a very small income. Applicant earned living as a teacher of music until the war commenced, but practically all her pupils have now given up. Voted £10, and referred to the Professional Classes War Relief Council.

Widow, aged 40, of M.B., Ch.M.Aberd. who died in 1914, and who practised at Manchester. Applicant left with seven children, aged 3 to 14 years; one son suffering from spinal disease. Only income a little from the sale of the practice. Requires help for the education of the children. Voted £5, and referred to the Guild.

Daughter, aged 57, of M.D. who practised at Kirkdale. Had earned a living at dressmaking until health became bad. Rent is paid by friends, but no income at present. Voted £12, in twelve instalments.

Widow, aged 44, of M.B., C.M.Glas., who practised at Lenton, and died in 1914 after a long illness, and was unable to provide for his widow. Earns a little as collector for a society, but not sufficient to keep her. Two children, 10 and 12. Voted £10 in two instalments.

Wife, aged 53, of M.R.C.S.Eng. who practised at Retford, but is now totally incapacitated from work, and is in a home. One son, who is being educated by a relative. Only certain income £8 per annum. Voted £5, with leave to apply again, and referred to the Guild for report.

Daughter, aged 68, of L.S.A. who practised at Christchurch. Has earned a living as an artist, but, owing to failing eyesight, unable to follow her profession, and unable to sell the few pictures she has on hand. Voted £18 in twelve instalments.

Widow, aged 42, of L.S.A. who died this year and had practised at Padstow. Husband was ill with general paralysis for four years before death. Has tried to keep her home together for some time by taking in boarders, but had none since the war commenced. One daughter, who is being educated at St. Ann's School. Voted £10.

Daughter, aged 33, of M.R.C.S.Eng. who practised at Whitechapel; lives with mother, who has an Epsom pension. Applicant worked in one situation for many years, but has been discharged owing to the war. Wants help to be trained as midwife. Training to be provided free, but outfit required. Appointment promised at end of training. Voted £12 through the Guild.

Daughter, aged 60, of M.R.C.S.Eng. who practised at Leeds. Applicant lives with her mother, who is a confirmed invalid. Lost all her capital in the Franklin frauds. Only income about £6 10s. per annum, and help from the Guild and the Fund. Previous help three times, £36. Voted £12 in twelve instalments.

Daughter, aged 53, of M.R.C.S.Eng. who practised at Rickmansworth. Suffering from arthritis and fibrosis. Only income £39 per annum from a relative. Quite unable to work. Relieved twice, £20. Voted £10 in two instalments.

Daughter, aged 58, of M.R.C.S.Eng. who practised at Peckham. Health very bad indeed. Only income £19 per annum from a sister. Relieved seventeen times, £197. Voted £12 in twelve instalments.

Widow, aged 59, of M.R.C.S.Eng. who practised at Maida Vale. Was left entirely without means, and suffering from chronic rheumatism and weak heart. Relieved twelve times, £118. Voted £15 in twelve instalments.

Daughter, aged 68, of M.R.C.S.Eng. who practised at Cranbrook. Very delicate and requires some one to look after her. Has an annuity from another benevolent fund, but not sufficient to maintain herself. Relieved sixteen times, £168. Voted £12 in twelve instalments.

(To be continued.)

The grants made at this meeting involve the Fund in an expenditure of £365 10s., to meet which there is only an available balance of £49. The claims on the Fund arising out of the war are increasing month by month, but the resources show a decrease. Immediate support is essential unless the reserves are to be seriously depleted. Subscriptions may be sent to the Hon. Treasurer, Dr. Samuel West, 11, Chandos Street, Cavendish Square, London, W.

The Royal Medical Benevolent Fund Guild appeals for gifts of secondhand clothing, boots, and shoes in good condition, also household linen. The gifts should be sent to the Secretary, Royal Medical Benevolent Fund Guild, 43, Bolsover Street, W.